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Scholarly Publications by the Faculty members of Periyar University, Salem, India: A Scientometric approach

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ABSTRACT

The present study aims to bring out the contributions made by the members of various departments of Periyar University, Salem. Further, it views the impact of the scholarly publications produced from Periyar University in India and the data analyzed for the study were retrieved from Web of Science (WOS) database for a period from 1998 to 2014. The study focuses on publishing trend, authorship pattern, and type of documents, country wise distribution of authors and individual authors' research publications and their TLCS, TCLS, TLCR and so on.

Keywords: Scientometrics, Bibliometrics, faculty, publications, Periyar University, research, WOS, Salem, India.

Introduction

Research productivity from any group and individuals pave a way to the growth of disciplines concerned. In India, UGC, DBT, ICSSR, DST and many other nodal agencies provide a large amount of money for carrying out research projects. These initiatives bring out tremendous changes in a field of knowledge. Faculty needs to be actively involved in teaching in general and research publications in particular numbers of collaborative research contributions are very common in any part of the globe. Accumulation of ideas brings about knowledge. Universities play a vital role in the application of new knowledge. Research contributions are conventionally categorized into four key areas such as education, research, conservation and extension. The success or failure of any university is statistically measured by the contributions of above said areas. The present study has been made an attempt to apply bibliometric analysis to measure the performance of research output of faculties such as Professors, Associate Professors and Assistant Professors in the Periyar University, Salem.

Profile of Periyar University

Periyar University (<http://www.periyaruniversity.ac.in/>) has been re-accredited with 'A' Grade by National Assessment and Accreditation Council (NAAC) recently and located at Salem, India. The University has shown tremendous growth in all the spheres of its 17 years of existence. It caters to the needs of students from rural areas and downtrodden sections of society

among Salem, Namakkal, Dharmapuri and Krishnagiri regions. The university receives funds from various agencies such as the UGC, CSIR, DBT, DST, ICMR, ICSSR, and MHRD to carry out research activities by different departments. The university has established exclusive centres for Bioinformatics, Nanoscience and Instrumentation. The central library of this university houses more than 75,000 books and 3000 back volumes of journals and 2800 dissertations. The UGC-INFONET digital library provides various e-resources and makes the learning process 24/7. Periyar University has an exclusive computer centre which takes care of web development. The network connectivity in the campus has lent a competitive edge to students, faculty and researchers in their academic and research pursuits.

Literature survey

Review of literature is one of the significant activities in research. Researchers found the relevant research area and the documents were correctly matched to the objectives and variables of the present study. Velmurugan and Radhakrishnan (2015) have carried out on Webology journal from the year 2007 to 2013 and the results found that the maximum numbers of research papers were produced by single authors and the lowest amount numbers of articles were published by co-authors. The majority of research articles were published during 2008 and the lowest numbers of scholarly papers were published in the year 2009. The greatest numbers of articles were contributed by Indian authors and placed first rank and the degree of collaboration was 0.506.

Hung et al (2015) have examined how universities perform in knowledge utilization with sample of world's top 300 research universities which are located in North America, Europe and East Asia during the period from 1995 to 2005 and the number of articles were collected using the SCI and SSCI databases and administered the statistical data by USPTO patent database. The results showed that out of 300 research universities, in 1995, 136 universities are located in Europe, 34 in East Asia and 130 in North America. In the year 2005, the above universities have been increased simultaneously. In this study, latent growth modeling is used for assessing the utilization of knowledge created by universities. The results revealed that not all top 300 research universities in the world perform well in knowledge utilization for patented inventions.

Morillo and Efrain-Garcia (2015) have investigated the Bibliometric analysis on technology centres of Spanish institutional sectors during the period between 2008 and 2012. The study covered TC's main functions and authors' performance, degree of national and international collaboration and their major features; evaluation of scholarly articles etc. for analysis, the data was collected from the web of science citation core database. The results showed that the total number of 5068 documents and 4586 research articles were published and produced by TCs. It was noticed that TC's scientific impact was slightly higher than the average.

Alijanianzadeh and Saboury (2014) have analyzed in their study on scientific publication by the Islamic Azad University (IAU) from beginning to February 2013. The data was collected from Web of Science (WOS) Database with the help of various versions such as Science, Social Science, Arts and Humanities. The results show that a total number of 18398 documents were published by IAU and most of the scientific publications were collaborated authors from USA. More than 4700 IAU documents were published in 37 journals. Vivekanandhan and Bathri

Narayanan (2014) carried out on research output of authorship trends and collaborative research in Bharathiyar University for the period 2009-2013. The data was downloaded using Scopus database. The findings revealed that the majority of 452 articles were published in 2013 and the largest numbers of research publications (87.86%) were published with multi-authorship pattern and the average degree of collaboration was 0.99.

Thirumagal (2012) observed the research publications of Manonmaniam Sundaranar University during 1992-2011. The data was gathered from Web of Science. To calculate the data, tool box such as Histcite and Bibexcel were used. The results show that the highest number of publications was in the year 2010. Since the multi-authored papers were high the collaborative research trend was evident in the field of scientific research and the maximum citation score was 61. Velmurugan (2013) examined authorship pattern and collaborative research work on Journal of Intellectual Property Rights (JIPR) for six years between 2007 and 2012. The results of the study showed that the highest numbers of papers (19.79 %) were published in 2012. The degree of collaboration was 0.34.

Hayati and Didegah (2010) have carried out the study on Iranian researchers' collaboration with their colleagues of other countries using science citation index to examine the scientific publications produced by them. The total records were 33,813 and the papers were employed the survey research techniques to answer the questions. Based on the study, the results revealed that the Iranian scientists have had collaboration with 115 countries and their research productivity have increased in the SCI database from 1998 to 2007. The results have also showed that the international collaboration in different subject areas revealed that geosciences had the higher number of publications and co-authored internationally.

Limitations

This paper has explored and investigated the scientific research publications (703) of Periyar University which have been indexed in Web of Science (WOS) database between 1989 and 2014.

Objectives of the study

The main objective of the present study is to identify the publication trends among the academic and research community of Periyar University during the period 1998 –2014.

- To know the year-wise distribution of the publications,
- To examine the document wise distribution
- To identify the authorship pattern of research publications,
- To trace the TLCS, TLCS/t, TLCSx, TGCS, TGCS/t, TLCR and TLCSb among the individual authors,
- To evaluate the relative growth rate (RGR), doubling time (DT) and degree of collaboration (DC) of the research output,
- To explore the collaborative countries of research contributions.

Methodology

The Science Citation Index- Expanded (SCI- E) and Social Sciences Citation Index (SSCI) and Arts and Humanities Citation Index (A &HCI) databases were chosen as the data source in this study. The data were retrieved in the area of Science and Technology from Web of Science (WOS) Core Collection online database. Periyar University scientific literature were found on WOS by searching the string “Periyar university”. The analysis is based on the research papers published by the faculty members of Periyar University. The time span was set between 1998 and 2014 so as to cover almost all the publications in the database. The bibliographic research work was performed on 15th May 2015. For data analysis, a descriptive analysis has observed, the collected data were transferred to Microsoft Excel for further analysis with suitable scientometric indicators such as RGR, DT and DC.

Analysis and Results

Table 1 (Fig. 1) indicates the chronology wise distribution of research output which were published and indexed in WOS database during the year 1998 to 2014. The faculty members of Periyar University had started to publish their research work from 1989 onwards and scientific productivity came out in the same year but the publication growth rate is gradually increasing till 2004 and after that the rate is growing rapidly till now. 703 scholarly publications were found from January 1998 to December 2014.

1. Year wise growth of research output

S.No	Years	Records	%	Rank	TLCS	%	Rank	TGCS	%	Rank
1	1998	1	0.14	15	0	0	0	0	0	0
2	1999	4	0.56	12	4	0.65	11	29	0.65	12
3	2000	2	0.28	14	4	0.65	11	4	0.08	14
4	2001	10	1.42	11	0	0	0	47	1.05	11
5	2002	3	0.42	13	0	0	0	1	0.02	16
6	2003	2	0.28	14	0	0	0	5	0.11	13
7	2004	1	0.14	15	0	0	0	3	0.06	15
8	2005	18	2.56	9	15	2.45	10	345	7.71	6
9	2006	12	1.72	10	19	3.10	9	221	4.94	8
10	2007	33	4.69	8	39	6.37	7	190	4.25	10
11	2008	47	6.68	7	64	10.45	5	559	12.50	3
12	2009	67	9.55	6	115	18.79	1	719	16.08	2
13	2010	81	11.52	4	91	14.87	2	799	17.87	1
14	2011	70	9.96	5	90	14.70	3	502	11.23	4
15	2012	97	13.79	3	87	14.21	4	500	11.18	5
16	2013	107	15.23	2	53	8.66	6	331	7.40	7
17	2014	148	21.06	1	31	5.07	8	214	4.78	9
Total		703	100		612			4469		

Table 1: Year wise growth of research output

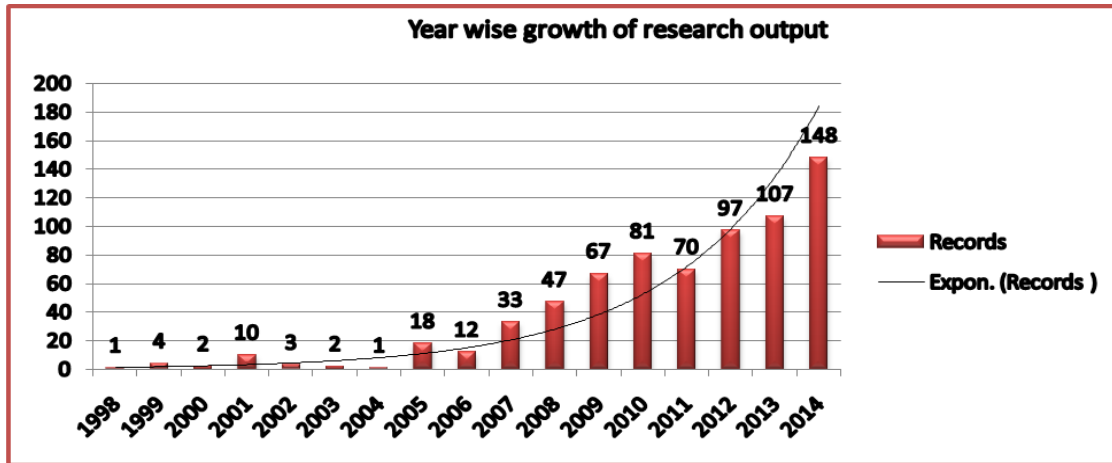


Figure 1: Year wise local citations of Publications

The study highlights the TLCS (Total Local Citation Score), TGCS (Total Global Citation Score), TLCR (Total Local Citation References), TLCSb (Total Global Citation Score in the beginning), and TLCSe (Total Local Citation Score at the end). Out of 703 research papers, the highest number of papers i.e. 148 that are placed in first rank in 2014. The maximum number of TLCS is 115 in 2009 (Fig. 1) and the maximum number of TGCS is 799 in 2010.

2. Distribution by Document

Further it has been identified the document-wise publications of faculty members during the period of study. It is evident from the table 2 that out of 703 articles, a majority of 684 (97.29%) scientific publications was published in scholarly journals. The TLCS is 601 and TGCS is 4334.

Type of Document	Record	%	TLCS	TGCS
Articles	684	97.29	601	4334
Review	6	0.85	6	122
Meeting abstract	5	0.72	0	0
Correction	3	0.43	1	1
Letters	3	0.43	0	0
Proceedings papers	1	0.14	0	12
Editorial Materials	1	0.14	0	0
Total	703	100	608	4469

Table 2: Document wise distribution

3. Authorship Pattern

It can be inferred from the table 3 that the highest number i.e. 218 (31.02%) of journal articles was contributed by three authors and followed by 166 contributions (23.61%) with two authors. 130 research papers (18.49%) were published by four authors 95 (13.52%) of contributions were done by four authors and twelve authors have contributed one paper each.

S. No	No of Authors	Total no of Records	Cumulative Records	% of Records	Cum. % of Records
1	Single	5	5	0.71	0.71
2	Two	166	332	23.61	24.32
3	Three	218	654	31.02	55.34
4	Four	130	520	18.49	73.83
5	Five	95	475	13.52	87.35
6	Six	44	264	6.26	93.61
7	Seven	19	133	2.71	96.32
8	Eight	14	112	1.99	98.31
9	Nine	7	63	0.99	99.3
10	Ten	2	20	0.28	99.58
11	Eleven	2	22	0.28	99.86
12	Twelve	1	12	0.14	100.0
Total		703	2612	100.0	

Table 3: Author productivity

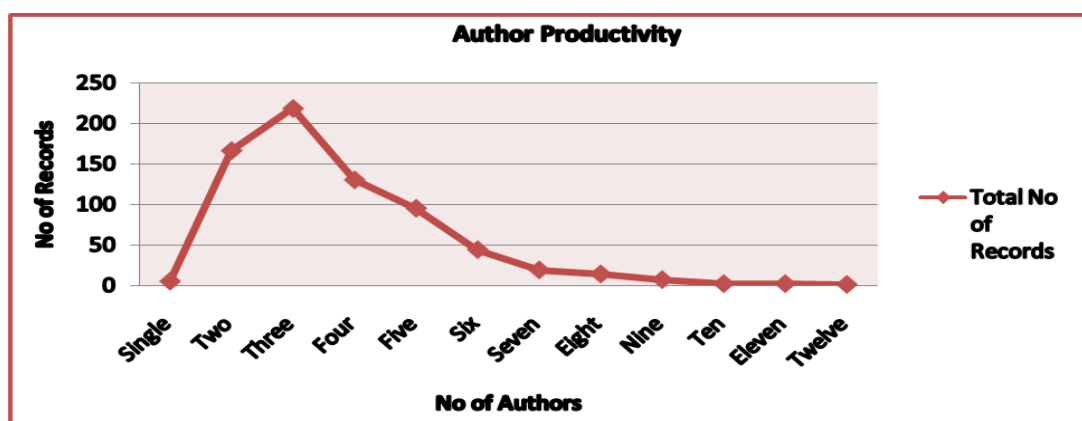


Figure 2: Author productivity

4. Year-wise authorship productivity

Scholarly publications of faculty were given in table 2 which represents the year wise authorship pattern during the chosen period. The results indicates that the highest number i.e. 148 (21.06%) papers were published in 2014 and followed by 107 (15.32%) papers which were published in 2013, 97 articles were published in 2012 and 81 research papers were contributed in 2010. It is understood that faculty members had taken remarkable efforts after 2005.

Years	Single	Two	Three	Four	Five	>Five	Total	Percentage
1998	-	1	-	-	-	-	1	0.14
1999	1	3	-	-	-	-	4	0.56
2000	-	2	-	-	-	-	2	0.28
2001	-	8	2	-	-	-	10	1.42
2002	-	2	1	-	-	-	3	0.42
2003	-	-	2	-	-	-	2	0.28

2004	-	-	1	-	-	-	1	0.14
2005	-	7	6	4	1	-	18	2.56
2006	-	6	2	3	1	-	12	1.72
2007	1	9	11	3	6	3	33	4.69
2008	1	9	20	8	7	2	47	6.68
2009		20	26	11	8	2	67	9.55
2010	1	15	36	10	11	8	81	11.52
2011	-	15	20	13	18	4	70	9.96
2012	-	28	24	18	21	6	97	13.79
2013	-	18	32	32	19	6	107	15.23
2014	1	23	35	28	40	21	148	21.06
Total	5	166	218	130	132	52	703	100.0

Table 4: Year wise authorship pattern

5. Research productivity of individual authors

It can be inferred from the table 5 that most prolific (Top 20) individual contributors of scientific articles were ranked during the period. The study shows that the TLCS, TGCS, TLCSb, TLCSb and TLCSe. Dr. V. Krishnakumar has got the first position and his total numbers of research publications are 111. He has got 105 in TLCS, 1159 in TGCS, 89 in TLCSb and 32 in TLCSb and followed by Dr. D. Gopi who occupied second position with TLCS is 217, TGCS is 644, TLCSb is 216, Dr. L. Kavitha stood third and her TLCS is 204, TGCS is 627 and TLCSb is 219, Dr. P. Viswanathamurthi got fourth position and Dr. PM. Anbarasan is in the fifth position.

S. No	Author	Recs	%	TLCS	TLCS/t	TLCSx	TGCS	TGCS/t	TLCSb	TLCSb
1	Krishnakumar V	111	15.8	105	17.49	16	1159	190.68	89	32
2	Gopi D	75	10.7	217	68.11	0	644	216.17	216	21
3	Kavitha L	75	10.7	204	65.65	0	627	217.38	219	16
4	Viswanathamurthi P	43	6.1	49	18.98	1	223	77.02	48	10
5	Anbarasan PM	41	5.8	19	4.22	1	227	45.92	20	1
6	Kumaradhas P	41	5.8	40	8.84	0	136	36.56	45	2
7	Nagalakshmi R	36	5.1	26	4.57	3	215	42.00	32	13
8	Palvannan T	33	4.7	37	9.28	0	245	64.59	33	1
9	Thandapani E	23	3.3	4	0.25	0	90	6.46	4	2
10	Raj V	21	3.0	12	2.68	0	67	17.47	12	2
11	Sathishkumar P	21	3.0	35	8.62	0	230	61.07	20	0
12	Sekar C	21	3.0	10	2.12	1	149	32.65	12	1
13	Velraj G	20	2.8	12	3.03	0	90	27.61	17	4
14	Mathammal R	18	2.6	10	1.86	2	118	28.13	24	2
15	Prabavathi N	18	2.6	19	4.03	1	223	46.00	26	3
16	Ramasamy AK	18	2.6	13	4.07	0	91	30.88	15	
17	Rajesh KB	16	2.3	14	2.90	0	84	20.32	14	1
18	Muthukumar M	15	2.1	21	3.77	1	72	13.42	14	10
19	Lalitha A	14	2.0	7	2.14	0	114	33.38	7	1
20	Kannan S	13	1.8	16	3.75	0	60	36.10	3	

Table 5: Research productivity of individual authors

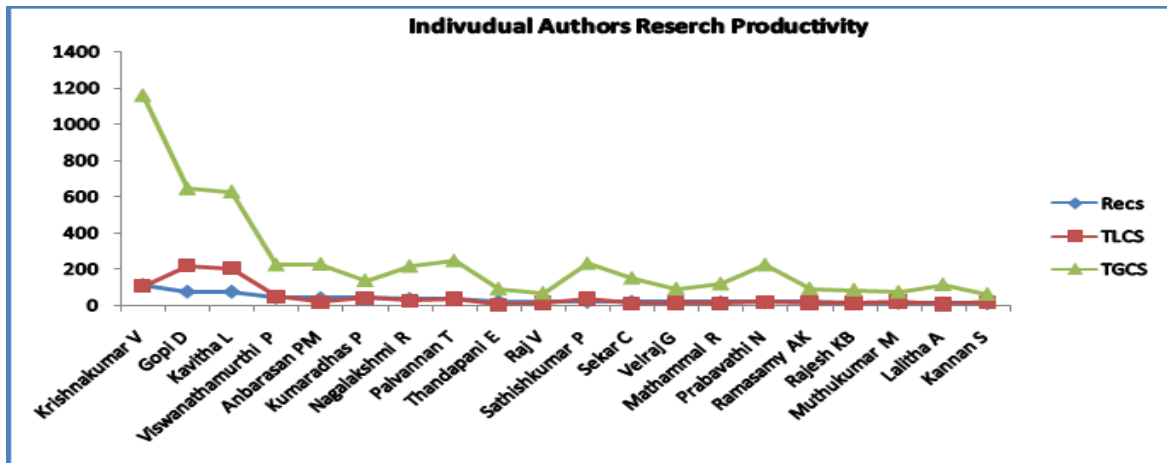


Figure 3: Research productivity of individual authors

6. Relative Growth Rate (RGR) and Doubling Time (DT)

The relative growth rate (RGR) will usually increase in terms of research publications / pages per unit of time. The relative growth rate and doubling time model were developed by Garg and Pathi (1999) to measure the publications. The mean growth rate $R(1-2)$ of total research output published by faculty members over a specific period of interval has been calculated according to the formula given below.

The formula is:

$$R(1-2) = \frac{(W_2 - W_1)}{(T_2 - T_1)}$$

Where,

$R(1-2)$ = mean relative growth rate over the specific period of interval

W_1 = $\log W_1$ (Natural log of initial number of publications)

W_2 = $\log W_2$ (Natural log of final number of publications)

$T_2 - T_1$ = Unit difference between the initial and final time

Therefore,

$R(a)$ = relative growth rate per unit of publications per unit of time (year)

$R(p)$ = relative growth rate per unit of pages per unit of time (year)

7. Doubling Time (DT)

It is found that a direct equivalence exists between the relative growth rate and the doubling time. If the number of research publications or pages of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be the logarithms of number 2. Then, the difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula.

$$\text{Doubling Time (DT)} = \frac{0.693}{\text{RGR}}$$

Table 6: Relative Growth Rate (RGR) and Doubling Time (DT)

Year	No. of Publications	Cumulative Total	W1	W2	RGR	DT
1998	1	0	0	0	0	0
1999	4	5	1.38	1.60	0.22	3.15
2000	2	7	0.69	1.94	1.25	0.55
2001	10	17	2.30	2.83	0.53	1.30
2002	3	20	1.09	2.99	1.90	0.36
2003	2	22	0.69	3.09	2.40	0.28
2004	1	23	0	3.13	3.13	0.22
2005	18	41	2.89	3.71	0.82	0.84
2006	12	53	2.48	3.97	1.49	0.46
2007	33	86	3.49	4.45	0.96	0.72
2008	47	133	3.85	4.89	1.04	0.66
2009	67	200	4.20	5.29	1.09	0.63
2010	81	281	4.39	5.63	1.24	0.55
2011	70	351	4.24	5.86	1.62	0.42
2012	97	448	4.57	6.10	1.53	0.45
2013	107	555	4.67	6.31	1.64	0.42
2014	148	703	4.99	6.55	1.56	0.44

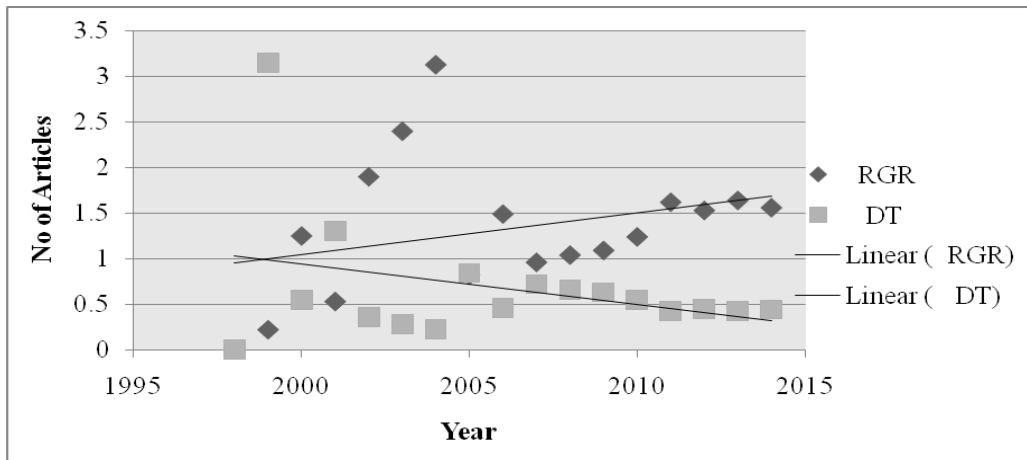


Figure 4: Relative Growth Rate and Doubling Time

It is inferred from the table 6 (fig.4) that the relative growth rates of total scholarly publications produced by the faculty members are gradually decreased. The growth rate is 0.22 in 1999 and it has been steadily decreased up to 1.56 in the year 2014 and the average growth rate is 1.318. The mean doubling time is 0.673 during the period of study and it has identified 3.15 in the beginning year (1999) and gradually decreased in 2014 i.e. 0.44. In general, the

doubling times as well as relative growth rate have been of scholarly publications of all sources also shown a decreasing trend.

8. Pattern of Single and Co- Authorship contributions

It represents Table 7 shows that out of 703 research output, the maximum numbers of articles were contributed by multi-authors i.e. 99.29 % while the rest of 5 (0.71%) articles were contributed by solo author. It is observed from the study that the majority of the faculty members are interested to publish their papers with co-authors and therefore the most of the scholarly publications were contributed by multi-authors.

Pattern	No of Articles	% of Records
Single	5	0.71
Co- authorship	698	99.29
Total	703	100.0

Table 7: Authorship pattern of single and joint contributions

9. Degree of Collaboration (DC)

Table 8 represents that the degree of collaboration (DC) on authorship in scholarly publications during the period of study. It is very clear to indicate the percentage of multi-authors which is more than the single author. To estimate the degree of collaboration in quantitative terms, the formula of K Subramanyam (1983) was used.

The formula is : $C = \frac{N_m}{N_m + N_s}$

Where,

C = Degree of Collaboration
 N_m = Number of Multi Authored Contribution
 N_s = Number of Single Authored Contribution

Hence, the value of C is $\frac{5}{5+698}$
 $= 0.99$.

The average degree of collaboration in “scholarly publications of Periyar University” is 0.99 which depicts the dominance upon multi - authored contributions.

Year	Single author	Multi-authors	Output	Collaboration
1998	-	1	1	1
1999	1	3	4	0.75
2000	-	2	2	1
2001	-	10	10	1
2002	-	3	3	1
2003	-	2	2	1

2004	-	1	1	1
2005	-	18	18	1
2006	-	12	12	1
2007	1	32	33	0.96
2008	1	46	47	0.97
2009	-	67	67	1
2010	1	80	81	0.98
2011	-	70	70	1
2012	-	97	97	1
2013	-	107	107	1
2014	1	147	148	0.99
Total	5	698	703	0.99

Table 8: Degree of Collaboration

10. Journal wise distribution of publications

Table 9 shows the significant journal publications of scientific research papers. Out of 297 journals, “SPECTROCHIMICA ACTA PART A-MOLECULAR AND BIOMOLECULAR SPECTROSCOPY” has published the highest number of articles i.e. 98 (13.9%) with TGCS (Total Global Citation Score) is 1142 and TLCR (Total Local Citation References) is 108 based on the results. Hence, the journal dominates by occupying the first rank of research output followed by “ASIAN JOURNAL OF CHEMISTRY” which has 17 papers (2.4%) and it has placed the second position and “JOURNAL OF RAMAN SPECTROSCOPY” has published 16 papers (2.3%) and it occupies third position.

S. No	Journal	Recs	%	TLCS	TLCS/t	TGCS	TGCS/t	TLCR
1	Spectrochimica ACTA Part A-Molecular and Biomolecular Spectroscopy	98	13.9	148	31.66	1142	222.90	108
2	Asian Journal of Chemistry	17	2.4	0	0.00	3	0.75	6
3	Journal of Raman Spectroscopy	16	2.3	4	0.64	116	19.30	6
4	Physica Scripta	12	1.7	0	0.00	125	27.53	19
5	E-Journal of Chemistry	10	1.4	2	0.40	52	9.01	1
6	Journal of Molecular Structure	10	1.4	7	2.00	48	18.00	8
7	Materials Letters	10	1.4	6	2.67	43	16.17	5
8	Optik	10	1.4	1	0.25	8	3.50	4
9	Computers & Mathematics with Applications	9	1.3	11	1.90	100	11.25	5
10	Indian Journal of Pure & Applied Mathematics	9	1.3	0	0.00	7	0.50	0
11	RSC Advances	9	1.3	3	1.50	17	15.00	24
12	Carbohydrate Polymers	7	1.0	19	5.83	63	24.17	4
13	Journal of Applied Electrochemistry	7	1.0	34	6.58	102	20.44	11
14	Bulletin of Materials Science	6	0.9	0	0.00	6	2.17	10
15	Chinese Physics B	6	0.9	0	0.00	8	6.00	21
16	Computational and Theoretical Chemistry	6	0.9	7	1.83	16	4.42	7

17	Indian Journal of Geo-Marine Sciences	6	0.9	0	0.00	3	0.75	1
18	Journal of Coordination Chemistry	6	0.9	4	0.77	26	5.70	12
19	Journal of Environmental Biology	6	0.9	2	0.33	5	1.00	1
20	Journal of Optoelectronics and Advanced Materials	6	0.9	2	0.37	12	2.07	1

Table 9: Journal publications

11. Global wise distribution of research output

S. No	Country	Recs	%	TLCS	TGCS
1	India	703	75.83	608	4469
2	South Korea	48	5.17	55	461
3	Italy	36	3.88	51	196
4	USA	16	1.72	5	115
5	Poland	15	1.62	12	111
6	Germany	13	1.41	8	58
7	Saudi Arabia	11	1.18	2	27
8	Portugal	9	0.98	23	59
9	Japan	8	0.87	15	67
10	Malaysia	7	0.76	0	6
11	Egypt	6	0.64	1	13
12	Finland	5	0.54	10	51
13	Spain	5	0.54	2	18
14	Hungary	4	0.44	4	29
15	Peoples R China	4	0.44	0	13
16	Serbia	4	0.44	4	14
17	UK	4	0.44	3	29
18	Chile	3	0.32	1	1
19	France	3	0.32	1	28
20	Iran	3	0.32	4	10
21	Singapore	3	0.32	11	53
22	Switzerland	3	0.32	3	17
23	Algeria	2	0.21	0	6
24	Austria	2	0.21	1	4
25	Cameroon	2	0.21	0	2
26	Canada	1	0.10	0	1
27	Iraq	1	0.10	0	1
28	Macedonia	1	0.10	11	21
29	Oman	1	0.10	0	0
30	Slovakia	1	0.10	0	0
31	Taiwan	1	0.10	0	0
32	Turkey	1	0.10	1	8
33	Vietnam	1	0.10	0	4

Table 10: Global wise distribution of research output

Researchers have analyzed the global-wise distribution of scholarly publications in which scientific articles were being published in all countries owing to technological development. Almost all scientific literatures are sorted out in terms of home country-wise and to identify the majority of prolific publications in India compared with other countries. Table 10 represents the global wise distribution of literature output cited in WOS and statistically got measured. 75.83 % of research output were published by India with TLCS is 608 and TGCS is 4469 occupied the first position, followed by the South Korea with 48 (5.17%) with TCLS is 55 and TGCS is 461 which was placed second next to India, followed by Italy, USA and Poland respectively.

12. Collaborative institutions through Research output

S. No	Institution	Recs	TLCS	TGCS
1	Sri Sarada College for Women	30	26	312
2	Abdus Salam Institute of Centre Theoretical Physics	29	43	173
3	National Institute of Technology	29	14	125
4	Bharathiar University	27	18	135
5	Anna University	26	19	249
6	Chonbuk National University	22	22	195
7	Alagappa University	21	6	291
8	Govt Arts College, Salem	19	15	204
9	Bharathidasan University	18	4	48
10	Annamalai University	14	10	55
11	Sungkyunkwan University	13	21	223
12	University of Madras	13	33	100
13	Chikkanna Govt Arts College	11	0	5
14	Central University of Tamilnadu	10	6	33
15	C Abdul Hakeem College	9	6	36
16	Sona College Technology	8	5	37
17	Sri Paramakalyani College	8	2	36
18	Womens Christian College	8	0	1
19	Adhiparasakthi Engineering College	7	0	34
20	Govt Arts College	7	1.0	6
21	Indian Inst Technology	7	1.0	6
22	King Saud University	7	1.0	1
23	Pondicherry University	7	1.0	1
24	Tata Inst Fundamental Research	7	1.0	10
25	AMET University	6	0.9	1

Table 11: Collaborative institutions

Table 11 shows that the top 20 institutions have collaborated with Periyar University during the period of time. A total number of 336 institutions have contributed research papers, out of 336 contributors, 75.86% were from Periyar University and the rest of 24.17% were from other institutions. Among the 336 institutions, Periyar University is in the top position, followed by Sri Sarada College of Women has got 30 articles with 26 TLCS and TGCS 312, Abdus Salam Institute of Centre Theoretical Physics has 29 contributions with TLCS is 43 and TGCS is 173,

National Institute of Technology has 29 research output with TLCS is 14 and TGCS is 125 and Bharathiar University has 27 research contribution with TLCS is 135.

13. Keywords distribution

Out of 2456 words, researchers have considered for research purpose the top 25 words only. Table 12 states that the majority of 91 papers (12.9%) with TLCS is 79 and TGCS is 548 which is placed in the first position of searching the word “SYNTHESIS”, followed by “CHARACTERIZATION” 70 papers (10.0%), “DENSITY” 67 articles (9.5%), ‘PROPERTIES’ 65 research output (9.2%), “VIBRATIONAL” 63 papers (9.0%) respectively.

S. No	Key words	Recs	Percent	TLCS	TGCS
1	Synthesis	91	12.9	79	548
2	Characterization	70	10.0	90	414
3	Density	67	9.5	73	570
4	Properties	65	9.2	30	202
5	Vibrational	63	9.0	57	679
6	Using	60	8.5	56	416
7	Analysis	50	7.1	49	340
8	Crystal	48	6.8	20	204
9	Complexes	46	6.5	45	193
10	Spectra	43	6.1	46	623
11	Structure	43	6.1	25	306
12	Nonlinear	41	5.8	55	265
13	Calculations	40	5.7	46	404
14	Effect	40	5.7	40	161
15	Functional	39	5.5	39	502
16	Spectral	38	5.4	28	248
17	Hydroxyapatite	36	5.1	101	343
18	Optical	36	5.1	18	196
19	Based	34	4.8	57	433
20	Chemical	34	4.8	20	272
21	Growth	34	4.8	28	201
22	Molecular	34	4.8	19	125
23	Raman	34	4.8	27	404
24	Acid	33	4.7	39	267
25	Ruthenium	32	4.6	39	153

Table 12: Key words distribution

14. Language wise Research output

Table13 represents that the Language wise scholarly communications published by Periyar university faculty members in which all the research articles were in English language. English language occupies a top position as far as nature of language being preferred.

S. No	Language	Recs	TLCS	TGCS
1	English	703	608	4469

Table 13: Language wise research output

Findings

The major findings are drawn based on the analysis done during the period of study.

- It is noteworthy to mention that out of 703 research papers, the highest number of papers i.e. 148 that are placed in first rank in 2014. The maximum number of TLCS is 115 in 2009 and the maximum number of TGCS is 799 in 2010.
- It is commendable to state that the most prolific contributors of scientific articles and found that Dr. V. Krishnakumar has got the first position and his total numbers of research publications are 111.
- It is identified from the study that the highest numbers of faculty members are interested to publish their papers with co-authors and therefore the most of the scholarly publications were contributed by multi-authors.
- It is understood that the average degree of collaboration in scholarly publications of Periyar University is 0.99 which depicts the ascendancy upon multi - authored contributions.
- It is found that global wise distribution, 75.83 % of research output were published by India which was occupied the first rank, followed by the South Korea was placed in the second position next to India, followed by Italy, USA and Poland respectively.
- Among the 336 institutions, Periyar University is in the top position, followed by Sri Sarada College of Women, Abdus Salam Institute of Centre Theoretical Physics, Institute of Technology and Bharathiar University
- The majority of papers (12.9%) with TLCS is 79 and TGCS is 548 which occupied in the first position of searching the word 'Synthesis'.

Conclusion

The study focuses the scholarly contributions of the faculty members of Periyar University between 1998 and 2014. The publication growth rate was very low till 2004 and there has been a steady growth of research publications since 2005. 2014 is identified as the most productive year due to the publications of 148 papers. It is observed that collaborative research among the institutions, South Korea is well associated with Periyar University. Researchers felt that the administrative body of Periyar University has provided the necessary facilities to enhance its research possibility towards knowledge production. Periyar university being a ten years old institution among the other reputed institutions in India strives for excellence in all the humanities and science disciplines. Knowledge consumption of the faculty has also motivated

the research scholars and students to involve in knowledge discovery through the research productivity by and large.

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